

CLAIMS

1 1. (currently amended) A method of selecting one of a plurality of queues for service, at
2 least one of the plurality of queues associated with a first traffic class, the method comprising the steps of:

3 (a) identifying each first traffic class (FTC) queue having at least one enqueued cell as an
4 occupied FTC queue wherein at least one FTC queue is provisioned for burst scheduling of multiple cells
5 when serviced;

6 (b) identifying an occupied FTC queue provisioned for burst scheduling as a super-occupied
7 FTC queue when the number of cells enqueued is greater than a specified number;

8 (c) setting as eligible for service each occupied FTC queue based on a FTC scheduling
9 algorithm, wherein, for step (c), the FTC scheduling algorithm is a shaped virtual clock algorithm; and

10 (d) selecting for service an eligible FTC queue based on a corresponding sub-priority of each
11 eligible FTC queue, wherein:

12 each FTC queue is assigned a sub-priority based on a service level of a connection associated
13 with enqueued cells; [[and]]

14 when the super-occupied queue is serviced, the number of cells dequeued is based on a burst size;
15 and

16 for step (c), each FTC queue has a corresponding down counter and service period value, wherein
17 step (c) further comprises the steps of, during a scheduling interval, counting down from the service
18 period value to a predefined value, and setting the corresponding FTC queue as eligible when the down
19 counter reaches the predefined value.

1 2. (original) The invention of claim 1, wherein, for step (a) the first traffic class comprises
2 traffic having a provisioned guaranteed level of service.

1 3. (canceled)

1 4. (original) The invention of claim 1, wherein step (a) comprises the steps of:

2 (a1) identifying whether a queue having cells associated with unicast traffic is occupied; and

3 (a2) identifying whether a queue having cells associated with multicast traffic is occupied.

1 5-6. (canceled)

1 7. (currently amended) The invention of claim [[6]] 1, wherein step (c) further comprises
2 the step of continuing to count from the predefined value to generate a service delay value, and for a
3 subsequent scheduling interval adjusting the service period value based on the service delay value.

1 8. (original) The invention of claim 1, wherein step (c) further comprises the step of further
2 setting an occupied FTC queue as eligible based on congestion information.

1 9. (previously presented) The invention of claim 1, wherein step (d) comprises the step of,
2 for each sub-priority, addressing with a pointer the FTC queue having the highest priority value within
3 those eligible FTC queues assigned to the sub-priority, the sub-priority of an eligible FTC queue based on
4 the order in which the eligible FTC queue is set as eligible.

1 10. (original) The invention of claim 9, further comprising the steps of: ranking each
2 sub-priority, selecting the FTC queue within a sub-queue based on the pointer, and selecting for service
3 the selected FTC queue from among the sub-queues based on the corresponding sub-queue's rank.

1 11. (original) The invention of claim 9, further comprising the steps of generating a bid
2 when the FTC queue selector selects a given FTC queue for service, and servicing the given FTC queue
3 when the bid is granted.

1 12. (previously presented) The invention of claim 1, wherein at least one of the plurality of
2 queues is associated with a second traffic class (STC), step (a) further comprises the step of identifying
3 each STC queue having at least one enqueued cell as an occupied STC queue, and the method further
4 comprises the steps of:

5 (e) setting as eligible for service each occupied STC queue based on a STC scheduling
6 algorithm;

7 (f) selecting for service an eligible STC queue based on the corresponding priority of the
8 eligible STC queue; and

9 (g) selecting one of the FTC queue selected for service, if present, and the STC queue
10 selected for service, if present.

1 13. (original) The invention of claim 12, further comprising the steps of assigning each FTC
2 queue priority over each STC queue, and selecting either the FTC queue or the STC queue based on the
3 assigned priority.

1 14. (original) The invention of claim 12, wherein, for step (e), the STC scheduling algorithm
2 is a weighted round robin scheduling algorithm.

1 15. (original) The invention of claim 12, wherein step (e) includes the step of accounting for
2 delay in service of each eligible STC queue.

1 16. (original) The invention of claim 12, for step (e), the second traffic class is best effort
2 traffic.

1 17. (original) The invention of claim 1, wherein the method is embodied as program steps in
2 a processor of an integrated circuit.

1 18. (currently amended) A scheduler for selecting one of a plurality of queues for service, at
2 least one of the plurality of queues associated with a first traffic class (FTC), the scheduler comprising:
3 an occupancy processor configured to identify each FTC queue having at least one enqueued cell
4 as an occupied FTC queue, wherein:

5 1) at least one FTC queue may be provisioned for burst scheduling of multiple cells
6 when serviced, and

7 2) an occupied FTC queue provisioned for burst scheduling is also identified as a
8 super-occupied FTC queue when a number of cells enqueued is greater than a provisioned number;

9 a FTC eligibility processor configured to set as eligible for service each occupied FTC queue
10 based on a FTC scheduling algorithm, wherein the FTC scheduling algorithm is a shaped virtual clock
11 algorithm; and

12 a FTC queue selector configured to select for service an eligible FTC queue,

13 wherein each FTC queue is assigned a sub-priority based on a service level of a connection
14 associated with enqueued cells, the FTC queue selector selects an eligible FTC queue based on the
15 corresponding sub-priority of each eligible FTC queue, and when the super-occupied FTC queue is
16 serviced, the number of cells dequeued is based on a burst size; and

17 wherein the FTC eligibility processor comprises a plurality of down counters, each FTC queue
18 having a corresponding down counter and service period value, wherein during a scheduling interval each
19 down counter counts from the service period value to a predefined value, and the corresponding FTC
20 queue is set as eligible when the down counter reaches the predefined value.

1 19. (original) The invention of claim 18, wherein the first traffic class comprises traffic
2 having a provisioned guaranteed level of service.

1 20. (canceled)

1 21. (original) The invention of claim 18, wherein the occupancy processor comprises:
2 a unicast occupancy processor configured to identify whether a queue having cells associated
3 with unicast traffic is occupied; and
4 a multicast occupancy processor configured to identify whether a queue having cells associated
5 with multicast traffic is occupied.

1 22-23. (canceled)

1 24. (currently amended) The invention of claim [[23]] 18, wherein, the down counter
2 continues to count from the predefined value to generate a service delay value, wherein for a subsequent
3 scheduling interval the service period value is adjusted based on the service delay value.

1 25. (original) The invention of claim 18, wherein the FTC eligibility processor receives
2 output port congestion information, and the FTC eligibility processor sets an occupied FTC queue as
3 eligible based on the congestion information.

1 26. (previously presented) The invention of claim 18, wherein, for each sub-priority, the
2 FTC queue selector comprises a pointer addressing the FTC queue having the highest priority value
3 within those eligible FTC queues assigned to the sub-priority, the priority of an eligible FTC queue based
4 on the order in which the eligible FTC queue is set as eligible by the FTC eligibility processor.

1 27. (original) The invention of claim 26, wherein each sub-priority is ranked, and the FTC
2 queue selector selects the FTC queue within a sub-queue based on the pointer, and selects for service the
3 selected FTC queue from among the sub-queues based on the corresponding sub-queue's rank.

1 28. (original) The invention of claim 26, wherein, when the FTC queue selector selects a
2 given FTC queue for service, a bid is generated and the given FTC queue is serviced when the bid is
3 granted.

1 29. (previously presented) The invention of claim 18, wherein at least one of the plurality of
2 queues is associated with a second traffic class (STC), the occupancy processor is configured to identify
3 each STC queue having at least one enqueued cell as an occupied STC queue, and the scheduler further
4 comprises:
5 a STC eligibility processor configured to set as eligible for service each occupied STC queue
6 based on a STC scheduling algorithm;
7 a STC queue selector configured to select for service an eligible STC queue based on the
8 corresponding priority of the eligible STC queue; and
9 a scheduler /arbiter controller configured to select one of the FTC queue selected for service, if
10 present, and the STC queue selected for service, if present.

1 30. (canceled)

1 31. (original) The invention of claim 29, wherein the STC scheduling algorithm is a
2 weighted round robin scheduling algorithm.

1 32-33. (canceled)

1 34. (original) The invention of claim 18, wherein the scheduler is embodied in a
2 telecommunications switch.

1 35. (original) The invention of claim 34, wherein the telecommunications switch is a three
2 stage switch, the plurality of queues are associated with connections received at a plurality of input ports
3 of the first stage, and the scheduler is embodied in the first stage to transfer cells to a plurality of input
4 links of the second stage.

1 36. (previously presented) The invention of claim 34, wherein the telecommunications
2 switch is a three stage switch, the plurality of queues are associated with cells received from output links
3 of the second stage, and the scheduler is embodied in the third stage to transfer cells from the plurality of
4 queues to a plurality of output ports.

1 37. (original) The invention of claim 18, wherein the scheduler is embodied in an integrated
2 circuit.

1 38. (currently amended) A computer-readable medium having stored thereon a plurality of
2 instructions, the plurality of instructions including instructions which, when executed by a processor,
3 cause the processor to implement a method of selecting one of a plurality of queues for service, at least
4 one of the plurality of queues associated with a first traffic class, the method comprising the steps of:

5 (a) identifying each first traffic class (FTC) queue having at least one enqueued cell as an
6 occupied FTC queue wherein at least one FTC queue is provisioned for burst scheduling of multiple cells
7 when serviced;

8 (b) identifying an occupied FTC queue provisioned for burst scheduling as a super-occupied
9 FTC queue when the number of cells enqueued is greater than a specified number;

10 (c) setting as eligible for service each occupied FTC queue based on a FTC scheduling
11 algorithm, wherein, for step (c), the FTC scheduling algorithm is a shaped virtual clock algorithm; and

12 (d) selecting for service an eligible FTC queue based on a corresponding sub-priority of each
13 eligible FTC queue, wherein:

14 each FTC queue is assigned a sub-priority based on a service level of a connection associated
15 with enqueued cells; [[and]]

16 when the super-occupied queue is serviced, the number of cells dequeued is based on a burst size;

17 and

18 for step (c), each FTC queue has a corresponding down counter and service period value, wherein
19 step (c) further comprises the steps of, during a scheduling interval, counting down from the service
20 period value to a predefined value, and setting the corresponding FTC queue as eligible when the down
21 counter reaches the predefined value.

1 39. (previously presented) The invention of claim 1, wherein more than one cell is dequeued
2 from the super-occupied queue during a single selection of the super-occupied queue for service.

1 40. (previously presented) The invention of claim 18, wherein more than one cell is
2 dequeued from the super-occupied queue during a single selection of the super-occupied queue for
3 service.

1 41. (canceled)

1 42. (previously presented) A method of selecting one of a plurality of queues for service, at
2 least one of the plurality of queues associated with a first traffic class, the method comprising the steps of:

3 (a) identifying each first traffic class (FTC) queue having at least one enqueued cell as an
4 occupied FTC queue wherein at least one FTC queue is provisioned for burst scheduling of multiple cells
5 when serviced;
6 (b) identifying an occupied FTC queue provisioned for burst scheduling as a super-occupied
7 FTC queue when the number of cells enqueued is greater than a specified number;
8 (c) setting as eligible for service each occupied FTC queue based on a FTC scheduling
9 algorithm; and
10 (d) selecting for service an eligible FTC queue based on a corresponding sub-priority of each
11 eligible FTC queue, wherein:
12 each FTC queue is assigned a sub-priority based on a service level of a connection associated
13 with enqueued cells;
14 when the super-occupied queue is serviced, the number of cells dequeued is based on a burst size;
15 and
16 step (d) comprises the step of, for each sub-priority, addressing with a pointer the FTC queue
17 having the highest priority value within those eligible FTC queues assigned to the sub-priority, the
18 sub-priority of an eligible FTC queue based on the order in which the eligible FTC queue is set as
19 eligible.

1 43. (previously presented) The invention of claim 42, further comprising the steps of:
2 ranking each sub-priority, selecting the FTC queue within a sub-queue based on the pointer, and selecting
3 for service the selected FTC queue from among the sub-queues based on the corresponding sub-queue's
4 rank.

1 44. (previously presented) The invention of claim 42, further comprising the steps of
2 generating a bid when the FTC queue selector selects a given FTC queue for service, and servicing the
3 given FTC queue when the bid is granted.

1 45. (canceled)

1 46. (previously presented) A scheduler for selecting one of a plurality of queues for service,
2 at least one of the plurality of queues associated with a first traffic class (FTC), the scheduler comprising:
3 an occupancy processor configured to identify each FTC queue having at least one enqueued cell
4 as an occupied FTC queue, wherein:
5 1) at least one FTC queue may be provisioned for burst scheduling of multiple cells
6 when serviced, and
7 2) an occupied FTC queue provisioned for burst scheduling is also identified as a
8 super-occupied FTC queue when a number of cells enqueued is greater than a provisioned number;
9 a FTC eligibility processor configured to set as eligible for service each occupied FTC queue
10 based on a FTC scheduling algorithm; and
11 a FTC queue selector configured to select for service an eligible FTC queue, wherein:
12 each FTC queue is assigned a sub-priority based on a service level of a connection
13 associated with enqueued cells;
14 the FTC queue selector selects an eligible FTC queue based on the corresponding
15 sub-priority of each eligible FTC queue;
16 when the super-occupied FTC queue is serviced, the number of cells dequeued is based
17 on a burst size; and
18 for each sub-priority, the FTC queue selector comprises a pointer addressing the FTC
19 queue having the highest priority value within those eligible FTC queues assigned to the sub-priority, the
20 priority of an eligible FTC queue based on the order in which the eligible FTC queue is set as eligible by
21 the FTC eligibility processor.

1 47. (previously presented) The invention of claim 46, wherein each sub-priority is ranked,
2 and the FTC queue selector selects the FTC queue within a sub-queue based on the pointer, and selects
3 for service the selected FTC queue from among the sub-queues based on the corresponding sub-queue's
4 rank.

1 48. (previously presented) The invention of claim 46, wherein, when the FTC queue selector
2 selects a given FTC queue for service, a bid is generated and the given FTC queue is serviced when the
3 bid is granted.

1 49. (canceled)

1 50. (new) A computer-readable medium having stored thereon a plurality of instructions, the
2 plurality of instructions including instructions which, when executed by a processor, cause the processor
3 to implement a method of selecting one of a plurality of queues for service, at least one of the plurality of
4 queues associated with a first traffic class, the method comprising the steps of:

5 (a) identifying each first traffic class (FTC) queue having at least one enqueued cell as an
6 occupied FTC queue wherein at least one FTC queue is provisioned for burst scheduling of multiple cells
7 when serviced;

8 (b) identifying an occupied FTC queue provisioned for burst scheduling as a super-occupied
9 FTC queue when the number of cells enqueued is greater than a specified number;

10 (c) setting as eligible for service each occupied FTC queue based on a FTC scheduling
11 algorithm; and

12 (d) selecting for service an eligible FTC queue based on a corresponding sub-priority of each
13 eligible FTC queue, wherein:

14 each FTC queue is assigned a sub-priority based on a service level of a connection associated
15 with enqueued cells;

16 when the super-occupied queue is serviced, the number of cells dequeued is based on a burst size;
17 and

18 step (d) comprises the step of, for each sub-priority, addressing with a pointer the FTC queue
19 having the highest priority value within those eligible FTC queues assigned to the sub-priority, the
20 sub-priority of an eligible FTC queue based on the order in which the eligible FTC queue is set as
21 eligible.

1 51. (new) The invention of claim 50, further comprising the steps of: ranking each
2 sub-priority, selecting the FTC queue within a sub-queue based on the pointer, and selecting for service
3 the selected FTC queue from among the sub-queues based on the corresponding sub-queue's rank.

1 52. (new) The invention of claim 50, further comprising the steps of generating a bid when
2 the FTC queue selector selects a given FTC queue for service, and servicing the given FTC queue when
3 the bid is granted.